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How special are black holes? Correspondence with objects saturating unitarity bounds in generic theories

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Black holes are considered to be exceptional due to their time evolution and information processing. However, it was recently proposed that these properties are generic for objects, the so-called saturons, that attain the maximal entropy permitted by unitarity. We verify this connection within a renormalizable $SU(N)$ invariant theory. We also review the concept of saturation of the universal micro-state entropy bound. We demonstrate that in the above theory, despite the absence of gravity, the bubbles, representing saturated bound states of $SU(N)$ Goldstones, exhibit properties that are in one-to-one correspondence to those of black holes. Additionally, we discuss the memory burden effect, by which a system is stabilized by the quantum information contained within it. This has important implications for black holes and saturons in general.

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